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# Geological Reports

ON THE

# Mineral & Timber Lands

OF

# D. KINGSBURY,

IN THE COUNTIES OF

CLEARFIELD, ELK, AND JEFFERSON, Co

STATE OF PENNSYLVANIA.

By Dr. DAVID DALE OWEN

AND

Prof. B. NEEDHAM.

BUFFALO:
COMMERCIAL ADVERTISER STEAM PRESS.

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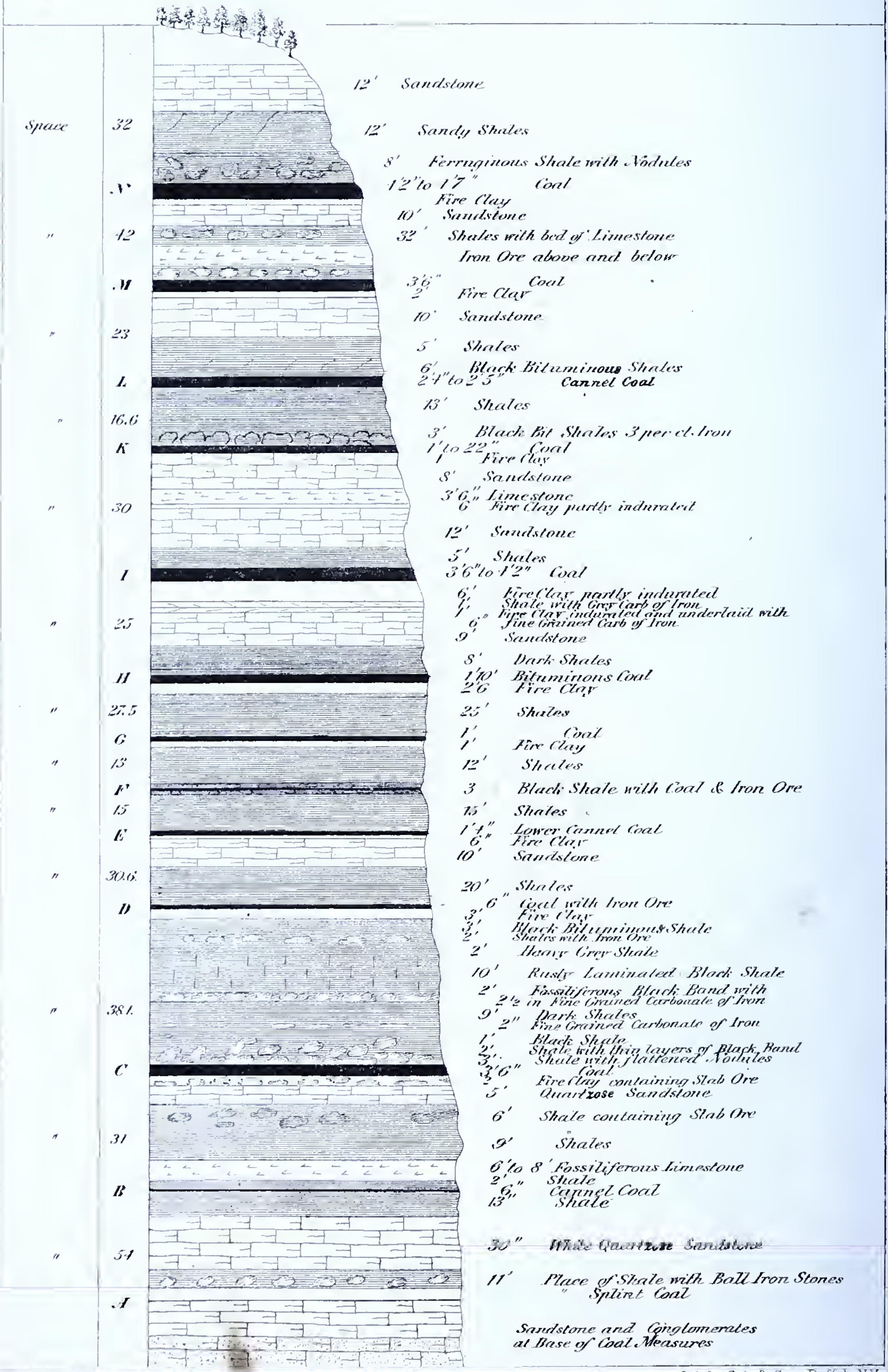
# VERTICAL SECTION

by Dr. D. D. Owen.


Space
32
12′ Sandstone
12′ Sandy Shales
8′ Ferruginous Shale with Nodules
N
1′2″ to 1′7″ Coal
Fire Clay
10′ Sandstone
″
42
32′ Shales with bed of Limestone
Iron Ore above and below
M
3′6″ Coal
2′ Fire Clay
10′ Sandstone
″
23
5′ Shales
6′ Black Bituminous Shales
L
2′4″ to 2′5″ Cannel Coal
13′ Shales
″
16.6
3′ Black Bit Shales 3 per ct. Iron
K
1′ to 22″ Coal
1′ Fire Clay
8′ Sandstone
3′6″ Limestone
″
30
6″ Fire Clay partly indurated
12′ Sandstone
5′ Shales
I
3′6″ to 1′2″ Coal
6′ Fire Clay partly indurated
1′ Shale with Grey Carb of Iron
1′ Fire Clay indurated and underlaid with
″
25
6″ Fine Grained Carb of Iron
9′ Sandstone
8′ Dark Shales
H
1′10′ Bituminous Coal
2′6 Fire Clay
″
27.5
25′ Shales
G
1′ Coal
1′ Fire Clay
″
13
12′ Shales
F
3 Black Shale with Coal & Iron Ore
″
15
15′ Shales
E
1′4″ Lower Cannel Coal
6″ Fire Clay
10′ Sandstone
″
30.6.
20′ Shales
D
6″ Coal with Iron Ore
3′ Fire Clay
3′ Black Bituminous Shale
2′ Shales with Iron Ore
2′ Heavy Grey Shale
10′ Rusty Laminated Black Shale
2′ Fossiliferous Black Band with
2½ in Fine Grained Carbonate of Iron
″
38.1.
9′ Dark Shales
2″ Fine Grained Carbonate of Iron
1′ Black Shale
2′ Shale with thin layers of Black Band
3′ Shale with flattened Nodules
C
3′6″ Coal
2′ Fire Clay containing Slab Ore
5′ Quartzose Sandstone
6′ Shale containing Slab Ore
″
31
9′ Shales
6′ to 8′ Fossiliferous Limestone
2′ Shale
B
6″ Cannel Coal
13″ Shale
″
54
30″ White Quartzose Sandstone
11′ Place of Shale with Ball Iron Stones
″ Splint Coal
A
Sandstone and Conglomerates
at Base of Coal Measures

Land Office of D. Kingsbury

Lith. by Sage & Sons, Buffalo, N.Y.

# GEOLOGICAL REPORT

ON THE

PROPERTY OF D. KINGSBURY,

SITUATE IN

# Elk, Clearfield and Jefferson Counties, Pa.

COMPRISING ABOUT 30,000 ACRES.

To Daniel Kingsbury, Esq.
Sir:

Having completed the survey and chemical analyses of the coal, iron ores, and limestones obtained from your lands lying partly in Elk, partly in Clearfield, and partly in Jefferson Counties, Pennsylvania, I am now prepared to submit the following Report on that property:

The mineral and timber lands in question are situated chiefly on the waters of the Little Toby River, a tributary of Clarion River; except those in some of the southern warrants, watered by the heads of the east branch of Sandy Lick Creek and Limestone Run, which under the name of the Red Bank River, after the union of its various branches, flows finally into the Allegheny River.

These tracts of lands constitute a body of very fertile vallies, and hills of moderate elevation, when compared with those of McKean County, formerly reported on; since they seldom exceed from 350 to 400 feet in elevation above the principal water-courses.

The Little Toby and its branches have cut through upwards of 400 feet of the coal-measures, which form a trough or basin coincident with the valley of that stream to where it enters Jefferson County, having a general bearing of about N. 40° to 50° E., and S. 40° to 50° W.

The dividing ridge which gives origin to Sandy Lick Creek and Limestone Run, on the south, and Rattlesnake Run on the north, is composed of conglomerates and sandstones of the millstone-grit series, constituting the range known as Boone's or Elk Mountain.

The anticlinal axis formed by these rocks along that ridge, limits the boundary of the productive coal-measures of the valley of the Little Toby, on the south-east; while the high table land, giving origin to the Laurel Branch of the Toby, the heads of Mead's Run and Brandy Camp Creek, is its boundary on the north-west.

On the southern declivity of Boon's Mountain, another synclinal sets in, so that the productive coal-measures reappear in the southern warrants of your lands lying on the heads of Sandy Lick and Limestone Run, bordering on the district known as the "Hickory Kingdom."

Not only does the immediate cut of the Little Toby present sections of these coal-measures, but every tributary of that stream, as it meanders the different tracts on which I am reporting; so that the explorer has frequent opportunities either of viewing the natural outcrop of the strata, or he is enabled, with but little labor, to expose to view the various beds of coal and ore which lie, as we shall see, in close proximity and succession.

Commencing with the Parkhurst section, exhibited in a small branch west of Brandy Camp Creek, the following succession was observed in the descending order:

| | Ft. In. |
|---|---|
| Light-olive shales overlying, | |
| Good blacksmith-coal, | 3.6 |
| Fire-clay, | 2. |
| Olive shales, | 20. |
| Black, bituminous shale, | 6. |
| Upper, main, cannel coal, (L.) | 2.4 |
| Bituminous coal, | 0.4 |
| Fire-clay, | 0.6 |
| Olive and black shales, | 13. |
| Black and ferruginous shales with nodules, | 3. |
| Coal, | 1. |

| | Ft. In. |
|---|---|
| Fire-clay, | 1. |
| Schistose, argillaceous sandstone, | 8. |
| Upper limestone, | 3.6 |
| Fire-clay, | 0.6 |
| Olive shales, | 12. |
| Hard black shales, probably overlying coal I of the general section, seen farther west on County Line Run, below which the rocks are concealed at this place. | |

Two miles and a half south-west of this, four to five outcrops of coal are seen between Oyster's Tavern and the "Oyster Bed" of coal, which is the H coal of the general section accompanying this Report, and measures two feet at its outcrop at this place. The other coals, G, F, and E, were but partially exposed at this place.

The next section obtained was on Chamberlain Run, 80 rods below Balltown mill:

| | Ft. In. |
|---|---|
| Limestone, | 3 to 5. |
| Ferruginous shales, | |
| Green, laminated sandstone, | 8. |
| Black, ferruginous shale, | 2.6 |
| Good bituminous coal, (H,) | 1.10 |
| Space concealed, | 20. |
| Outcrop of coal, | 0.6 |
| Space concealed, | 10. |
| Black shale and space concealed, | 4 to 6. |
| Outcrop of coal, (F,) | |
| Coarse carbonate of iron, | |
| Space mostly filled with black shale and ore, | 15. |

Here we have, evidently below the green, laminated sandstone, a repetition of the same beds of coal seen at Oyster's.

On Warrants 4470 and 4452, on the waters of County Line Run, coal probably equivalent to M coal of the general section, is opened 155 feet above the flats of Toby Bottom. It measures here 4 feet. Eight to ten feet above these bottoms, a coal has been opened, associated with black shales, which is considered equivalent to the E coal of the general section; and 60 feet above it, a limestone was observed, which is probably the middle limestone, under the indurated fire-clay with ore, on which coal I reposes, which has been opened up a ravine to the west, where it measures 3½ feet. Here the indurated fire-clay, which is found beneath this coal, is of very superior quality, and includes two beds of iron ore in the following descending succession with the superimposed strata:

| | Ft. In. |
|---|---|
| Schistose, olive-green sandstone, | 8. |
| Upper limestone, | 3.6 |
| Fire-clay, | 0.6 |
| Brown, speckled, micaceous sandstone, | 12. |
| Dark-olive shales, | 5. |
| Main coal of County Line Run, (I coal of the section,) | 3.6 |
| Fire-clay, in part indurated, (probably all solid under a good cover) | 6. |
| Ferruginous shales, with bands or pavements of grey carbonate, | 1. |
| Fine-textured, indurated fire-clay, | 0.6 |
| Fine-grained, light-blue carbonate, | 0.6 |
| Place of middle limestone, | |
| Grey and buff micaceous sandstones, | 8. |

On Warrant 1534, opposite Balltown mill, the best section is exposed of the dark shales and associated ore beds, overlying coal C, which lies just below the water of Toby, at the foot of the dam at this locality:

| | Ft. In. |
|---|---|
| Coal, (D) | 0.6 |
| Fire-clay, | 3. |
| Black, bituminous shale, | 10. |
| Shale, with ball ore, | 1. |
| Solid, grey carbonate of iron, | 1.3 |
| Heavy, grey, ferruginous shale, | 1. |
| Rusty, laminated, ferruginous shale, | 10. |
| Fossiliferous, black-band ore, containing chonetes, | 2. |
| Dark shale, | 8. |
| Black shale, including 2 to 3 inches solid, fine-grained carbonate of iron, | 13. |
| Shale, with small nodular ore, | 2. |
| Black-band shales and balls, | 2 to 3. |
| Ferruginous shale, | 2. |
| Shales, containing large quantities of the finest quality of dark-grey, fine-grained carbonate of iron in nearly continuous bands, and very large, flattened balls—in all | 3. |
| Balltown coal, (C) | 3.6 |

These same shales and ores are seen, with some modification, on Warrant 4241, on the waters of Rattlesnake Run.

On Muddy Run, I coal has been opened 90 feet above the Toby Bottom, where it has a cuboidal structure, and measures 3 feet 8 inches at its outcrop. Five to ten feet below this coal, fragments of dark, coarse-textured limestone, with rusty surfaces, were found; no doubt occupying the place of the ore and associated, indurated fire-clay which underlies the corresponding coal of the County Line Run — the intermediate space between the coal and upper limestone being filledw ith olive shales and sandstone. At 200 feet above the bottom, there is the appearance of the outcrop of coal N, and the overlying shale contains some balls of carbonate of iron.

In a neighboring hollow, limestone is again seen at about 120 feet, the I coal at 100 feet, and underlying limestone at 90 feet above the bottom of Toby.

On Mead's Run, a 22 inch coal (K) is exposed, 10 feet above limestone. A space succeeds in the ascending order of 70 to 75 feet, filled chiefly with thin-bedded sandstone, with probably the upper cannel coal L, and also coal M; these were, however, not exposed to view when I inspected the section on this Run. At 75 feet above the 22 inch (K) coal, and 85 feet above the limestone, (upper,) coal N has been opened, and measures here 3 feet 10 inches.

None of the sections on Toby extend sufficiently low to bring coal A of McKean county to view, so that I am not not able to pronounce as to its thickness in the Toby valley.

On Whetstone Run, the lower, fossiliferous limestone, which overlies the shales forming the roof of B coal, is more than 6 feet in thickness: 26 feet above this limestone, the coal C crops out. Toward the top of the hills, some 200 feet above the valley of Toby, on this Run, the outcrop of coal E is seen about 10 feet higher than on the opposite side of the valley, while the I coal skims the tops of the hills.

About one mile south of this section, the sandstones and conglomerates of the millstone-grit, make their appearance on the flank of Boone's mountain. In the shales, about 25 feet above the C coal, there are some 8 inches of fossiliferous black-band ore, and 18 inches of black-band shale.

On the Sandy Lick Tract, adjacent to "Hickory Kingdom," on the head of Limestone Run, on Warrant 4234, the upper limestone is well exposed.

On a branch of the West Branch of Mountain Branch—waters of Sandy Lick—coal N crops out 4 feet 7 inches thick. The coal here has a dip of 14° to the south-east. It is covered with about 8 feet of dark, sandy shales, with immense, flattened nodules of carbonate of iron imbedded. At an elevation of 20 feet above the coal, a bench of 12 to 14 feet is formed, of gritty, olive shales. This coal, which is the equivalent of the highest workable coal yet opened in the Toby section, is here near the water-courses, in the centre of the 6000 acre tract owned by you, on the south side of the Boone's Mountain axis: hence all the lower coals of the general section can be reached in succession at or near the respective distances indicated on the general section, buter opping out rapidly on the northern limits of the tract.

The Rogers' Run Tract occupies the high ridge and table land between the Little Toby and Brandy Camp, on Warrants 4245 and 4246. Here the N coal lies from 60 to 80 feet beneath the table land; while the lower, fossiliferous limestone and B coal are visible toward the base of the hills. Between this limestone and C coal, there are two important beds of iron ore, still lower in the coal-measures than those beds previously described at Balltown mill, above the C coal. Their geological position will be observed by the following section:

| | Ft. | In. |
|---|---|---|
| Coal, (C) | 3. | |
| Fire-clay, | 2. | |
| Shale, with upper "slab ore," | 5 to 6. | |
| Hard sandstone, | 5. | |
| Shale, with lower "slab ore," | 4 to 6. | |
| Dark shale, | 9. | |
| Lower, fossiliferous limestone, | 6 to 8. | |
| Dark-olive shales, | | |
| Coal outcrop, (B) | | .6 |
| Black and olive shales, | 12. | |
| White, quartzose sandstone, | 30. | |

These two beds of iron ore, overlying the lower, fossiliferous limestone, are no doubt equivalent to the lower and upper slab ores which overlie a corresponding fossiliferous limestone in Armstrong county, Pennsylvania; and doubtless, also, the equivalent of the "Buhrstone ore" of the Pennsylvania survey, overlying its "encrinital limestone" toward the base of the coal-measures.

The KYLER TRACT, situated on the Kyler Branch of the Little Toby, on Warrants 4083 and 4079, contains only the C coal, lower limestone and associate beds, since it borders on the sandstones and conglomerates of the millstone-grit—an extension of the formation of the Boone's Mountain anticlinal.

The THOMPSON RUN TRACT, on Warrants 4247 and 4248, on the heads of Brandy Camp, is located on the lower coal-measures, extending up to I coal of the general section; and the same is true of the LITTLE TOBY TRACT, on Warrants 4079 and 4080.

The KERSEY and BEAVER RUN TRACTS, on Warrants 4093, 4095, 4094, and 4096, are situated on the anticlinal of the Boone's Mountain Range, where the afore-mentioned sandstones and conglomerates reach the surface, and therefore contain no available coal ; or at least none upon which any reliable calculation can be made.

From the preceding, it appears that the Little Toby, from its source in Elk County to the south-west limits of the lands on which I am reporting, on the confines of Jefferson County, flows nearly centrally through what may be regarded as a distinct basin, formed by a synclinal axis of the coal-measures, which has an average width, from N. W. to S. E., of about seven miles ; and a length, from N. E. to S. W., of nearly twelve miles, to where the Little Toby makes an abrupt bend to the north.

In this valley, in a vertical height of about 400 feet, twelve distinct beds of coal can be inspected: not all at one locality, but in succession, on the various Tracts just enumerated. These coals have a united thickness of 25 feet. Five of these beds of coal may be considered workable; one approaching a semi-bituminous character; three being bituminous coals; and one, cannel. The average united thickness of these workable beds is about 17 feet.

The general section exhibits the whole of these beds, together with the intervening strata in detail. The coals are lettered from B to N, inclusive ; A being only problematical, or inferred from analogy in McKean County. The workable beds are lettered C, I, L, M, and N.

The following list shows the succession and spaces at which these various beds of coal lie in relation to each other:

| | | Ft. In. | Ft. In. |
|---|---|---|---|
| Space to summit, | 100 ft. to | | 112. |
| N coal, | | 4.7 | |
| Space, | | | 43. |
| M coal, | | 3.6 | |
| Space, | | | 23. |
| L coal, (cannel,) | | 2.5 | |
| Space, | | | 16.6 |
| K coal, | | 1.10 | |
| Space, | | | 30. |
| I coal, | 3.6 to | 4.2 | |
| Space, | | | 25. |
| H coal, | | 1.10 | |
| Space, | | | 27.5 |
| G coal, | | 1. | |
| Space, | | | 13. |
| F coal, | 0.6 to | 1. | |
| Space, | | | 15. |
| E coal, | | 1.4 | |
| Space, | | | 30.6 |
| D coal, | | 0.6 | |
| Space, | | | 38.1 |
| C coal, | | 3.6 | |
| Space, | | | 31. |
| B coal, | | 0.6 | |
| | | 26.2 | 404.6 |

# TABLE OF ANALYSIS OF COAL

## From Elk and McKean Counties, Pennsylvania, and other Localities.

| | ELK COUNTY. | | | | | McKEAN COUNTY. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Kingsbury Tract. | | | | | Kingsbury Tract. | | | |
| | C | I | L | M | N | Splint. | Cannel. | Newell. | Davis. |
| Thickness of seam, | 3½ feet. | 3½ to 4⅓ft | 2½ feet | 3½ feet. | 4½ feet. | 4 to 5 ft. | | 5 feet. | 5¼ feet. |
| Specific Gravity, | | | | | | 1.294 | | 1.318 | 1.321 |
| Total volatile matter, | 29.35 | 35.35 | 33.35 | 34.2 | 33.7 | 34. | | 39. | 41. |
| Coke, | 70.65 | 64.65 | 66.65 | 65.8 | 66.3 | 66. | | 61. | 59. |
| | 100. | 100. | 100. | 100. | 100. | 100. | | 100. | 100. |
| Moisture, | 3.40 | 1.20 | 1.20 | 3.8 | 1.6 | 2, | .62 | 1.5 | 1 5 |
| Volatile & bitum. matter. | 25 95 | 34 15 | 32.15 | 30.4 | 32.1 | 32. | 41 77 | 37.5 | 39.5 |
| Fixed carbon in coke, | 67 85 | 57.95 | 51.85 | 62.0 | 62.4 | 59. | 46.45 | 56. | 55. |
| Ashes, | 2.80 | 6.70 | 14.80 | 3.8 | 3.9 | 7. | 11 16 | 5. | 4. |
| | 100. | 100. | 100. | 100. | 100. | 100. | 100. | 100. | 100. |
| Color of Ashes, | Reddish. | | | Light Buff. | | Gray. | | Light Gray. | Dark Gray. |
| Land Office, D. Kingsbury. | Coke, lamellar, bright and compact, well adapted for manufacture of Iron and general uses—free from impurities. | Very superior gas coal. | Sample analysed had, from long exposure, lost considerable hydrogen—under good roof will prove an excellent coal for production of oil. | Superior to Youghloghei y coal for manufacturing and blacksmith uses. | A strong rich lasting coal for manufacturing purposes, a good gas coal. | Well adapted for the manufacture of iron, ranks high for efficiency in evaporating water, a good grate coal, free from pyritiferous impurities. | Adapted to the manufacture of oils and gas. | Fat, partially coking coal with long flame, rich in hydro-carbon, well adapted for gas. | |

| | PENNSYLV'A. | KENTUCKY. | | | OHIO. | VIRGINIA. | GREAT BRITAIN. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | South'n Margin. | Eastern Margin. | | | | | | | | |
| | Pittsburg. | Hon. Jno. Bell's Mines. | Brecken-ridge. | Hawes-ville. | Pomeroy. | Clover Hill. | Worsboro' Furnace Coal. Splint. | Morley Park Furnace Coal. | Clyde Iron Works. | Newc'stle | Bowling. |
| Thickness of seam, | 4 feet. | 3 to 4 ft. | 2⅜ feet. | 3½ to 4 ft. | | | 4½ feet. | | | | 22 inch's |
| Specific Gravity, | | 1.274 | | 1.397 | | 1.285 | | | | 1.257 | |
| Total volatile matter, | 36.46 | 39.40 | | 47. | | 32.94 | 38.18 | 37.86 | | 37.60 | 32.55 |
| Coke, | 63.54 | 60.60 | | 53. | | 67.06 | 61.82 | 62.14 | | 62.40 | 67.45 |
| | 100. | 100. | | 100. | | 100. | 100. | 100. | | 100. | 100. |
| Moisture, | 1.11 | 3. | .77 | 8. | 3 49 | .73 | | | | 1.77 | |
| Volatile & bitum. matter. | 35.35 | 36.40 | 63.52 | 39. | 35.80 | 32.21 | 38.18 | 37.86 | 36.80 | 35.83 | 32.55 |
| Fixed carbon in coke, | 60.14 | 57.60 | 27.16 | 46. | 47.72 | 56.83 | 60.32 | 55.89 | 59. | 57. | 65.45 |
| Ashes, | 3.40 | 3. | 8.47 | 7. | 12.99 | 10.23 | 1.50 | 6.25 | 4.20 | 5.40 | 2. |
| | 100. | 100. | 99.92 | 100. | 100. | 100. | 100. | 100. | 100. | 100.00 | 100.00 |
| Color of Ashes, | Gray. | Pale Flesh Color. | | | White. | | White. | Gray White. | | | Drab. |
| | | Highly esteemed for the use of steamboats, and for domestic purposes. | Fossil lepidodendron in body of the coal. | | Slaty, free burning, leaves no clinkers. | | Used for Iron smelting, splint coal with bright lines of bituminous coal alternatives, surface covered with bright cubes of pyrites. | A cannel coal; fracture partly in lines, and partly yolky, in places conchoidal and oolitic. | | In very general use throughout England. | Iron made with this coal, very superior, and celebrated for car axles and locomotive tire. |

The shaly spaces between some of these coals contain, as we have seen, numerous beds of iron ore, six or eight of which may be considered workable: viz., the upper and lower slab ores, between coals B and C; three beds of carbonate of iron, between C and D coals; the two beds of carbonate under the I coal, associated with the fine-textured, indurated fire-clay, and the ball ore over the N coal.

The qualities and chemical composition of the various workable coals and iron ores, on the lands on which I am reporting, will be seen by consulting the following chemical analyses:

## *Analysis of Coal C.*

| | | | |
|---|---|---|---|
| Moisture, | 3.4 | | |
| Volatile, combustible matter, | 25.95 | Total volatile matter, | 29.35 |
| Fixed carbon in coke, | 67.85 | Coke, (compact; structure lamellar,) | 70.65 |
| Ashes, (reddish,) | 2.8 | | |
| | 100.00 | | 100.00 |

*Ultimate analysis of C coal, with moisture and ashes included in the calculation.*

| | |
|---|---|
| Moisture, | 3.400 |
| Carbon, | 77.318 |
| Hydrogen, | 3.611 |
| Sulphur, | .900 |
| Ashes, | 2.800 |
| Oxygen, nitrogen, and loss, | 11.971 |
| | 100.000 |

*The same, calculated for* 100 *parts of dry combustible matter, gives:*

| | |
|---|---|
| Carbon, | 81.559 |
| Hydrogen, | 3.703 |
| Sulphur, | .950 |
| Oxygen, nitrogen, and loss, | 13.788 |
| | 100.000 |

These analyses prove this a most excellent coal, approaching in the large amount of fixed carbon—70.65 per cent.—to a semi-bituminous coal. It affords a bright, compact coke, of a lamellar structure. It is free from impurities, and altogether well adapted to the manufacture of iron, generating steam, and, indeed, to any purpose to which coal is applied. It resembles the furnace coals of South Wales, especially the "*Varteg three-quarter coal*" used at the Pentwyn Iron Works.

In the amount of fixed carbon in the coke, it resembles the Cumberland coal of Maryland, used at the Navy Yard at Washington; but it differs in the amount of volatile matter from the semi-bituminous coal, having nearly twice as much volatile combustible matter. It is freer from earthy impurities than that coal, which has ten per cent. more ashes than the C coal of Toby.

### *Analysis of I Coal.*

| | | | |
|---|---|---|---|
| Moisture, | 1.20 | | |
| Volatile, combustible matter, | 34.15 | Total volatile matter, | 35.35 |
| Fixed carbon in coke, | 57.95 | | |
| Ashes, | 6.70 | Coke, (inflated,) | 64.65 |
| | 100.00 | | 100.00 |

*Ultimate analysis of the same, calculated with moisture and ashes.*

| | |
|---|---|
| Moisture, | 1.200 |
| Carbon, | 75.763 |
| Hydrogen, | 5.500 |
| Sulphur, | 1.050 |
| Ashes, | 6.700 |
| Oxygen, nitrogen, and loss, | 9.787 |
| | 100.000 |

*Calculated for* 100 *parts of dry combustible matter, this gives:*

| | |
|---|---|
| Carbon, | 82.262 |
| Hydrogen, | 5.972 |
| Sulphur, | 1.141 |
| Oxygen, nitrogen, and loss, | 10.625 |
| | 100.000 |

This is a very fine gas coal. It contains nearly the same quantity of hydrogen as an English coal now used along with other coals at the Manhattan Gas Company's works, in New York, and only 3.219 less carbon than that coal.

*Analysis of Coal L.*

| | | | |
|---|---|---|---|
| Moisture, | 1.20 | | |
| Volatile, combustible matter, | 32.15 | Total volatile matter, | 33.35 |
| Fixed carbon in coke, | 51.85 | | |
| Ashes, | 14.80 | Coke, (not changed in form,) | 66.65 |
| | 100.00 | | 100.00 |

*Ultimate analysis of the same, calculated with moisture and ashes.*

| | |
|---|---|
| Moisture, | 1.200 |
| Carbon, | 70.745 |
| Hydrogen, | 5.011 |
| Sulphur, | 1.300 |
| Ashes, | 14.800 |
| Oxygen, nitrogen, and loss, | 6.944 |
| | 100.000 |

*Calculated for* 100 *parts of dry combustible matter, this gives:*

| | |
|---|---|
| Carbon, | 84.220 |
| Hydrogen, | 5.964 |
| Sulphur, | 1.527 |
| Oxygen, nitrogen, and loss, | 8.289 |
| | 100.000 |

By distillation, at a low red heat, for the oily products, this coal gave the following results: 2000 grains gave of crude oils 340 grains, which is equal to 17 per cent., or 340 pounds to the ton of 2000 pounds, which would be equal to 42.5 gallons of crude oil to the ton of 2000 pounds; and would afford from 20 to 25 gallons of the purified oils to the ton.

This coal afforded at the same time, from the 2000 grains, 640.9 cubic inches of good illuminating gas, which is equal to 2246 cubic inches to the pound.

For the sake of comparison, I here subjoin the results obtained from Breckenridge coal, under the same circumstances,—the richest oil coal of this country.

From 1000 grains, it gave 318 grains of crude oil, which is equal to 31.8 per cent., or 636 pounds to the ton of 2000 pounds. This is equal, very nearly, to 80 gallons to the ton of 2000 pounds, and will afford 35 to 40 gallons of the purified oils to the ton. At the same time it yielded a paler gas, with less illuminating power, equal to 445.9 cubic inches from 1000 grains, or 3021 cubic inches from one pound of this coal. The smaller amount in per cent. of oily products, afforded by the Toby coal, is partly to be accounted for from the considerable amount of ash, (14.8 per cent.) and partly from the smaller proportion of hydrogen, caused by long exposure of the specimen analysed, taken from the outcrop which has been subject to deterioration and evaporation of the more volatile ingredients, and does not show as fine results as if taken from under a good mine roof.

*The Analysis of the M Coal gave,*

| | | | |
|---|---|---|---|
| Moisture, . . . . . | 3.8 | | |
| Volatile, combustible matter, | 30.4 | Total volatile matter, . | 34.2 |
| Fixed carbon in coke, . . | 62.0 | | |
| Ashes, . . . . . | 3.8 | Coke, (somewhat inflated,) | 65.8 |
| | 100.0 | | 100.0 |

*Ultimate analysis of the same, calculated with moisture and ashes,*

| | |
|---|---|
| Moisture, . . . . . . . . . . | 3.800 |
| Carbon, . . . . . . . . . . | 73.500 |
| Hydrogen, . . . . . . . . . . | 4.944 |
| Sulphur, (none,) . . . . . . . | |
| Ashes, (bright buff,) . . . . . . . | 3.800 |
| Oxygen, nitrogen, and loss, . . . . . | 13.956 |
| | 100.000 |

*Calculated for* 100 *parts of dry combustible matter, this gives:*

| | |
|---|---|
| Carbon, . . . . . . . . . . | 79.653 |
| Hydrogen, . . . . . . . . . . | 5.357 |
| Sulphur, (none,) . . . . . . . | |
| Oxygen, nitrogen, and loss, . . . . . . | 14.990 |
| | 100.000 |

This is an excellent coal, containing fully as much fixed carbon in the coke as the best Youghiogheny coal, though not quite so much in the volatile matter; a fraction less hydro-

# COMPARATIVE ANALYTICAL TABLE OF IRON ORES.

| | IRON ORES FROM THE KINGSBURY TRACT, ELK COUNTY. | | | | | | | | IRON ORES FROM THE KINGSBURY TRACT, MCKEAN COUNTY, PENNSYLVANIA. | | | | | | | | KENTUCKY. | GREAT BRITAIN. | | | | | | | | CLAY IRON STONES, IN NODULES AND BEDS, IN THE COAL MEASURES OF FRANCE. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Finegrained Carbonate over C Coal. | Upper Slab Ore. | Lower Slab Ore. | 15 inch Band of Carbonate, 14 ft. below D Coal. | Gray Carbonate under I Coal. | Carbonate under Fossiliferous Black Band Shale. | Fossiliferous Ore. | Granular Gray Ore over N Coal. | Black Band, 1 foot 6 inches. | Black Band Shales, overly'g Black Band Ore. | Fine Carbonate, over lying Newel Coal. | Nodular Shales, found in the roof of Splint Coal. | Rockwell Cut, 1st Variety. | Rockwell Cut, 2d Variety. | Rockwell Cut, 3d Variety. | Rockwell Cut, Limonite. | Black Band, 6 to 12 inches thick under Bell Seam. | Crossbasket, Grayish Black. | Crossbasket, Light-Grayish Black. | Crossbasket, Brownish-Blk. | Crossbasket. | Clyde Iron Works. | Clyde Iron Works. | Easter House. | Airdrie Mushet's Black Band. | Magescote. | Fine. | Veschera. | Morillon. | Mouillar, 1st Variety. | Mouillar, 2d Variety. | St. Etienne, 1st Variety. | St. Etienne, 2d Variety. |
| Specific Gravity, | | | | | | | | | 3.069 | 2.161 | | | | 3.201 | | | 3.22 | 3.3801 | 3.2699 | 3.1175 | 3 1793 | 3.1482 | 3.2109 | 3.3109 | 3.0553 | | | | | | | | |
| Carbonic Acid, | | | | | | | | | 29 95 | | 27.2 | 10. | 24.66 | 18. | 17.2 | 5.7 | *40.43 | 33.63 | 31.86 | 30.76 | 32 53 | 26 35 | 33.10 | 32 24 | 35 17 | ‡25.50 | ‡27.70 | ‡24 60 | ‡21.00 | ‡ 9.10 | ‡14 6 | ‡12.20 | ‡38 40 |
| Protoxide of Iron, | | | | | | | | | 56.25 | 18. | 54. | 25.2 | 36. | 20.09 | 23.24 | 8 05 | | 45.34 | 42.15 | 38.80 | 35.22 | 36 47 | 47.33 | 43 73 | 53 03 | 25. | 37.30 | 13. | 20.30 | 38. | 40. | 38. | 41. |
| Peroxide of Iron, | | .7 | | | | | | | | | | | 9.99 | 12.04 | 12.24 | 60.46 | 20.21 | | 0.80 | 0.33 | 1.16 | 0.40 | 0 33 | 0.47 | 0.23 | | | | | | | | |
| Protoxide of Manganese, | | | | | | | | | | | | | | | | | | 0.20 | | 0 07 | | 0 17 | 0 13 | | | 0 30 | 1 70 | 0.30 | 0.60 | 1.40 | 1.50 | 2.50 | 4.10 |
| Lime, | 4.5 | 3 7 | 6. | 6 3 | 4 2 | | | | 1. | 1. | 2. | 1.5 | 1.5 | 4.5 | 2. | 0.5 | 14.10 | 1.90 | 4.93 | 5.30 | 8.62 | 1 97 | 2 00 | 2.10 | 3.33 | | 6 00 | 7.40 | 4 20 | | | 13 00 | 0.20 |
| Magnesia, | 3.39 | .4 | 1.5 | 1 5 | 2 2 | | | | .72 | 1.45 | 1.8 | 1.64 | 1.26 | 1.4 | 1.4 | 0.36 | .03 | 5.90 | 4.80 | 6.70 | 5.19 | 2 70 | 2 20 | 2 77 | 1.77 | 1.60 | 1.90 | 0 80 | 0 30 | 2.60 | 3.00 | 1.50 | 0.20 |
| Insoluble Silicates, | 7. | 28.9 | 32.7 | 14. | 20. | 13. | 17 5 | 23. | 6.50 | 53. | 11 5 | 56. | 25. | 38 5 | 38.5 | 17. | 14.87 | †7.83 | 9.73 | 10.87 | 9.56 | 19 20 | 6 63 | 9.70 | 1.40 | 26 50 | 25 00 | 47.10 | 47 40 | 44.40 | 35.70 | | 12 00 |
| Alumina, | 2. | 3. | 1.8 | 3.2 | 2. | | | | 2. | 5.5 | 3.5 | 4 5 | 1. | 4.0 | 3.5 | 4. | 5.80 | 2.53 | 3.77 | 6.20 | 5.34 | 8 03 | 4.30 | 5 13 | 0 63 | 11.8 | 0,9 | 6.3 | 3.30 | 4.4 | 5.5 | 2.00 | 3.10 |
| Bituminous Matter, | | | | | | | | | | | | | | | | | 1.32 | 1.86 | 2.33 | 1.87 | 2.13 | 2.10 | 1.70 | 1.50 | 3.03 | | | | | | | | |
| Moisture, | 3. | | | | 1.2 | | | | 0.8 | | | 0.6 | | .80 | | 3.5 | 3.24 | .99 | | | | | | | | | | | | | | | |
| Sulphur, | | | | | | | | | 0 025 | | | | 0.06 | | | | | | | 0.16 | .62 | | 0 22 | .02 | | | | | | | | | 1. |
| Loss and Alkalies not estimated, | .36 | | | | 3.4 | | | | 2.755 | 21,05 | | .56 | .53 | .67 | 1.92 | .43 | | | | | | | | | | | | | | | | | |
| Carbonate of Iron, | 79 75 | 63 3 | 58. | 75. | 67. | 73.5 | 60 46 | 65.20 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 100. | 100. | 100. | 100 | 100 | | | | 100. | 100. | 100. | 100. | 100. | 100. | 100. | 100. | 100. | 100 68 | 100.57 | 101.06 | 100.37 | 97 39 | 97.94 | 97 66 | 98 59 | 100.70 | 100.50 | 100. | 98. | 99.90 | 100.30 | 100.20 | 100. |
| Metallic Iron, | 35.7 | 31 1 | 28. | 37 8 | 32 9 | 35 75 | 30.6 | 31.5 | 43.73 | 14. | 42.01 | 21.72 | 35. | 24.01 | 27.35 | 48.65 | 33.73 | 35.66 | 33.34 | 30.41 | 28.01 | 28.64 | 37.04 | 34.26 | 41.41 | 27.19 | 29 01 | 10 11 | 15.79 | 29 56 | 31.12 | 29.56 | 31.89 |

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* 40.43 Carbonate of Iron.

† 0.80 Phosphoric Acid.

‡ Loss by Calcination mostly Carbonic Acid.

gen; and 4.082 more oxygen; hence it will not be quite as good a gas coal, but equally well adapted to other manufacturing and domestic purposes.

### *Analysis of the N Coal.*

| | | | |
|---|---|---|---|
| Moisture, | 1.6 | | |
| Volatile, combustible matter, | 32.1 | Total volatile matter, | 33.7 |
| Fixed carbon in coke, | 62.4 | | |
| Ashes, | 3.9 | Coke, (inflated,) | 66.3 |
| | 100.0 | | 100.0 |

*Ultimate analysis of the same, calculated with the ashes and moisture.*

| | |
|---|---|
| Moisture, | 1.000 |
| Carbon, | 79.390 |
| Hydrogen, | 3.988 |
| Sulphur, | .100 |
| Ashes, | 3.900 |
| Oxygen, nitrogen, and loss, | 11.022 |
| | 100.000 |

*Calculated for* 100 *parts of dry combustible matter, this gives:*

| | |
|---|---|
| Carbon, | 84.015 |
| Hydrogen, | 4.220 |
| Sulphur, | 1.058 |
| Oxygen, nitrogen, and loss, | 10.707 |
| | 100.000 |

This coal is even richer in fixed carbon in the coke than M coal; while the volatile, combustible matter has 5.890 more carbon, but one per cent. less hydrogen, and nearly six per cent. less oxygen and nitrogen. It will, therefore, be found to be a strong, rich, lasting coal for manufacturing purposes, and a good gas coal at the same time.

For the analyses of the principal iron ores, I refer you to the accompanying table, contrasting their composition with those of McKean County, Pa., Kentucky, Great Britain, and France.

*Analysis of Lower Limestone.*

| | |
|---|---|
| Carbonate of lime, . . | 91.5 |
| Carbonate of magnesia, . . | 2.2 |
| Alumina and oxide of iron, . | 2.3 |
| Insoluble earthy matter, . . | 3.5 |
| Loss, alkalies, &c., . . | .5 |
| | 100.0 |

*Analysis of Upper Limestone.*

| | |
|---|---|
| Carbonate of lime, . . | 79.6 |
| Carbonate of magnesia, . . | 3.7 |
| Alumina and oxide of iron, . | 5.0 |
| Insoluble earthy matter, . . | 8.6 |
| Loss, alkalies, &c., . . | 3.1 |
| | 100.0 |

The foregoing chemical analyses afford a complete exposition of the composition and qualities of the workable coals, the most extensive beds of ore, together with the two principal limestones that occur on your property, on the Toby and Sandy Lick.

The general section gives the thickness of the beds, both of coal and iron.

---

I proceed now to give an estimate of the amount of workable coal and iron ore on the various tracts:

| Name of Tract. | Tons of Bituminous. | Tons of Cannel. | Total Tons of Coal. |
|---|---|---|---|
| Rattlesnake, . . . | 15,271,000 | 2,850,000 | 18,121,000 |
| Balltown, . . . . | 33,146,638 | 6,480,000 | 39,626,638 |
| Steam Mill, . . . | 34,962,638 | 7,050,000 | 42,012,638 |
| Sandy Lick, . . . . | 47,728,036 | 9,120,000 | 56,848,036 |
| Rogers' Run, . . . | 10,224,520 | 1,915,000 | 12,139,520 |
| Brandy Camp, . . . | 11,267,920 | 2,100,000 | 13,367,920 |
| Thompson Run, . . | 1,125,000 | | 1,125,000 |
| Kyler Branch, . . . | 2,012,500 | | 2,012,500 |
| Little Toby, . . . | 3,025,500 | | 3,025,500 |
| Total, . . . | 158,763,752 | 29,515,000 | 188,278,752 |

On the above tracts, the quantity of iron ore is estimated to be capable of yielding,

| | | | |
|---|---|---|---|
| On the Rattlesnake | Tract, . | 13.880.000 | tons of pig metal. |
| " " Balltown | " . . | 25,440,000 | " " " |
| " " Steam Mill | " . | 29,000,000 | " " " |
| " " Sandy Lick | " . . | 31,376,000 | " " " |
| " " Rogers' Run | " . | 7,240,000 | " " " |
| " " Brandy Camp | " . . | 7,640,000 | " " " |

| | | |
|---|---|---|
| On the Thompson Run Tract, . | 1,200,000 | tons of pig metal. |
| " " Kyler Branch " . . | 2,200,000 | " " " |
| " " Little Toby " . | 3,400,000 | " " " |
| Total, . . | 121,376.000 | tons. |

The coal-measures of the Little Toby and its branches as above described, form, as we have seen, a complete trough or elongated basin,—the strata rising from near the synclinal axis of the Toby valley, on the south-east, up the flank of the Boone's Mountain range; and on the north-west turn up to the high land from which County Line, Muddy, and Mead's Runs take their rise: hence the porous layers, lying deep under the valley of the Toby, are favorably situated for retaining any saline matters which may have crystallized in their cavities and interstices as the coal-measures gradually rose from the ocean, and its waters, by degrees, evaporated.

It is, therefore, highly probable that borings for salt water, in the most depressed portion of this valley, would yield a good brine, from which salt could be made with profit; for the conformation of the valley does not appear to afford any channel by which such saline impregnations could have been subsequently drained away. I infer from this, that at the depth of 600 to 1400 feet, strong brines could be reached by judicious borings, and salt made with profit; particularly in connection with such a convenient and ample supply of coal for fuel as the Toby country presents; at least, the strong probability would justify the attempt.

When the contemplated lines of the Sunbury & Erie and Allegheny Valley Railroads shall be completed, so as to bring this rich mineral region in easy communication with the Pittsburgh and eastern markets, the Toby valley will be able to furnish an unlimited supply of the raw material for the support of the most extensive iron business; besides the vast amount of the best quality of bituminous coal fit for manufacturing purposes, production of gas, domestic use, and every purpose to which coal is applied. The projected line of the Allegheny Valley Railroad crosses Toby only two miles below the Balltown and Rattlesnake Tracts.

225726

Even now, a considerable business might be done in the iron trade, by boating the iron down the Toby into the Clarion, and thence into the Allegheny River; as immense quantities of timber and lumber are every year rafted out through this channel.

When we consider that the total amount of workable coal on the Little Toby and Sandy Lick waters amounts to 158,763,752 tons of bituminous, and 29,515,000 tons of cannel coal; and that its ores are capable of yielding, at a very moderate calculation, 121,376,000 tons of pig metal; while its forests on your land in this valley, and on the heads of Sandy Lick, can supply upwards of 200,000,000 feet of the *very best kind* of pine lumber, besides the immense quantity of hemlock and hard wood; and when we bear in mind that the country, for Pennsylvania, is level, while the soil is mostly derived from argillaceous shales, often calcareous, with frequent beds of limestone and argillaceous sandstones intercalated, we have, what is very rarely combined, a rich mineral, and a fertile agricultural country, supporting a primitive forest of as valuable timber as the State can afford; with a fair prospect of an abundant supply of salt; the best quality of fire-clay, and abundance of good limestone for a flux, and sandstone suitable for furnace hearth-stone. It would be difficult, therefore, to over-estimate the great natural resources of this country, which, when fairly opened up and brought in easy communication, by lines of railroad, with the populous regions within and without the State, must inevitably, before long, be the centre of a new effort to supply our country with what it needs more than anything else, in a commercial point of view—a full supply of railroad and other iron, for which, at the present time, the United States is drained of thirty millions of dollars annually, by having to purchase of foreign countries, the greater part of this, next to provisions, the most indispensable article of consumption which a civilized country demands.

D. D. OWEN,
Geologist.

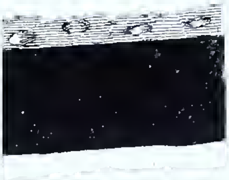
## ENLARGED SECTION

*by Prof. B. Needham.*

## ANALYSIS

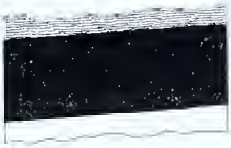
*by Dr. D.D. Owen.*

**N** — *Bituminous Coal 4½ F$^{t}$*



| | | | |
|---|---|---|---|
| Moisture | 1. 6. | Total Vol. Matter | 33.7 |
| Volatile Matter | 32. 1 | Coke | 66. 3 |
| Fixed Carbon | 62. 4 | | |
| Ashes | 3. 9. | | |
| | 100 | | 100 |

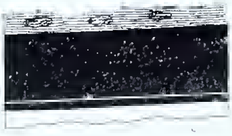
**M** — *Bit Coal 3½ F$^{t}$*



| | | | |
|---|---|---|---|
| Moisture | 3 8 | Vol Matter | 34. 2 |
| Vol. Matter | 30 4 | Coke | 65. 8 |
| Fixed Carbon | 62 | | |
| Ashes | 3 8 | | |
| | 100 | | 100 |

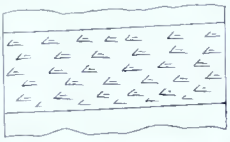
**L** — *Cannel Coal 2½ F$^{t}$*

*Bit " 4 in.*



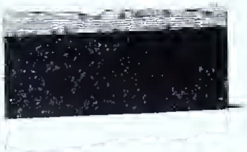
| | | | |
|---|---|---|---|
| Moisture | 1. 2 | Vol. Matter | 33. 35 |
| Vol. Matter | 32. 15 | Coke | 66.65 |
| Fixed Carbon | 51. 85 | | |
| Ashes | 14. 80 | | |
| | 100 | | 100 |

*Grey Compact Limestone 3⅓ F$^{t}$*



*Yields 79.6 per ct Carbonate of Lime*

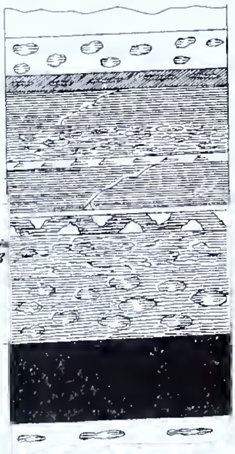
**I** — *Bit. Coal 3½ F$^{t}$*



| | | | |
|---|---|---|---|
| Moisture | 1. 2 | Vol. Matter | 35. 35 |
| Vol. Matter | 34. 15 | Coke | 64.65 |
| Fixed Carbon | 57. 95 | | |
| Ashes | 6. 7 | | |
| | 100 | | 100 |

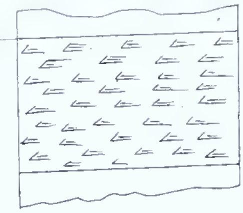
| Section | Analysis |
|---|---|
| *Shale with Ore 2 F$^{t}$* | *Yields 37. 8 per ct Metallic Iron* |
| *Grey Carbonate 1 F$^{t}$* | |
| *Shale* | |
| *Fossiliferous Black Band 2"* | *" 12.25 to 30.6 " " "* |
| *Band of Carb 2½ in* | |
| *Shale* | |
| *Band of Carb 2 in* | *" 35.75 " " "* |
| *Shale with Black Band 2 3 F$^{t}$ in* | |
| *with Nodules 3 F$^{t}$* | *" 35.7 " " "* |

**C** — *Bit. Coal 3½ F.*



| | | | |
|---|---|---|---|
| Moisture | 3 40 | Vol. Matter | 29.35 |
| Vol. Matter | 25 95 | Coke | 70. 65 |
| Fixed Carbon | 67 85 | | |
| Ashes | 2 80 | | |
| | 100 | | 100 |

*Fossiliferous Limestone 6 F$^{t}$*



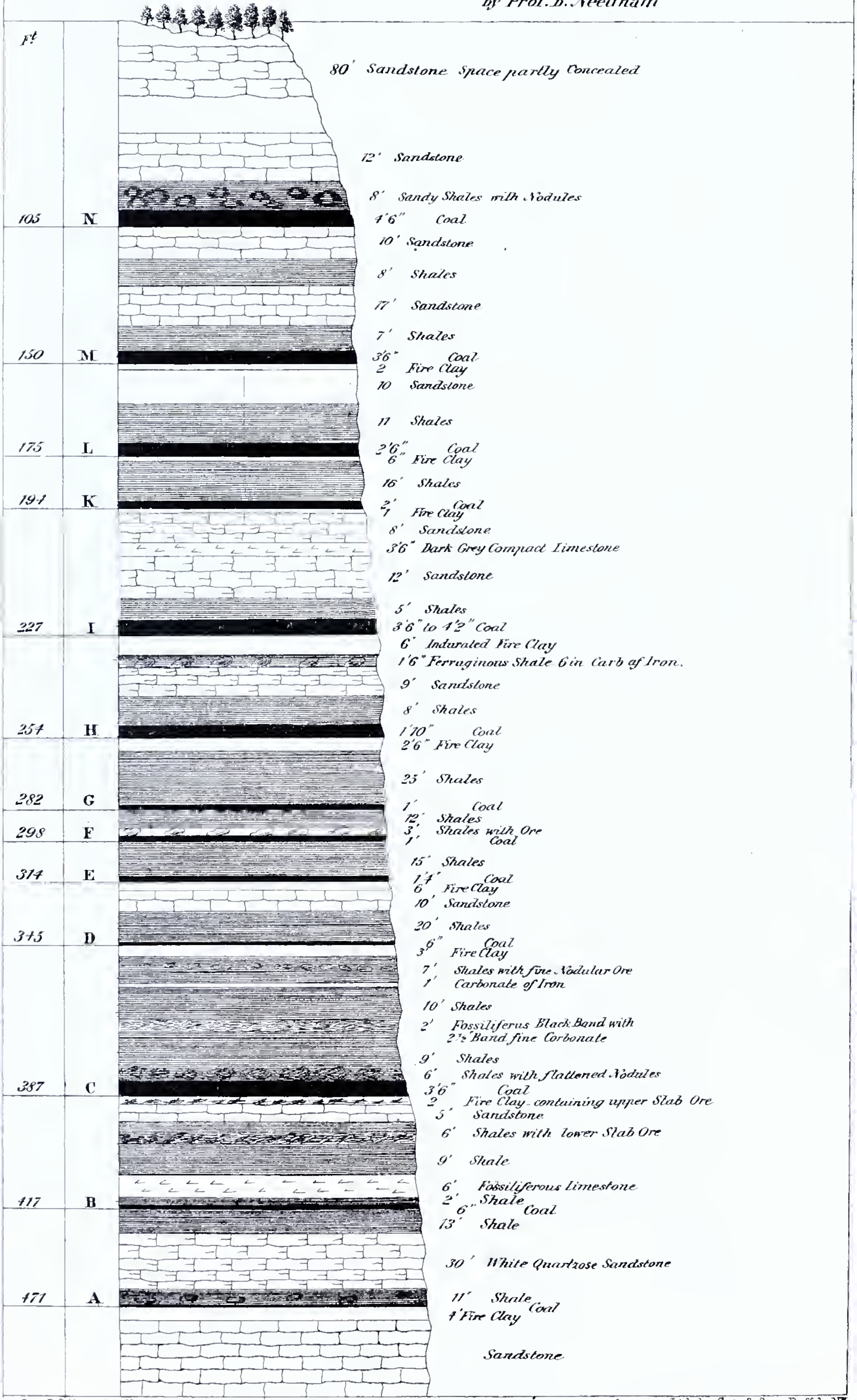
*Yields 91.5 per cent Carbonate of Lime*

Land Office of D. Kingsbury.

Lith. by Sage & Sons, Buffalo, N.Y.

# VERTICAL SECTION

*by Prof. B. Needham*



Land Office of D. Kingsbury.

Lith. by Sage & Sons, Buffalo, N.Y.

# REPORT ON LANDS

OF

## D. KINGSBURY,

SITUATE IN THE

## Counties of Elk, Clearfield, and Jefferson, Pa.

COMPRISING ABOUT 30,000 ACRES.

Col. D. Kingsbury,
Dear Sir:

Pursuant to your request, I visited, in company with Dr. Owen, your lands in Elk and adjoining counties, and after a long and laborious survey and examination of your property, submit my views and the result of our explorations, together with an approximate estimate of the quantities of the timber, cannel and bituminous coals, iron ores, &c., on the same, and a vertical and transverse section of the stratification.

These lands are situated in the basin or valley of the Little Toby Creek, and embrace all the great mineral deposits of the coal-measures of this district. The Little Toby runs through the valley near the synclinal axis or basin, the course of which is north 40° east, and south 40° west. The anticlinal axis or ridge on which the coal-measures are all lifted out, is about four miles from the Clarion River on the north-west, and Boone's Mountain forms the corresponding axis on the south-east, making the basin which includes the coal-measures at the junction of the Brandy Camp Creek and the Little Toby, seven and a-half miles wide.

As we go north-eastwardly towards the Alleghany River, in Potter and McKean Counties, the coal-measures are gradually lifted out and terminate in those counties. On either side of the narrow valley of the Toby, the lands rise to an elevation of three to four hundred feet, forming high table lands, which are intersected by small streams and rivulets, locally called "runs," and "draughts," and which include nearly all the minerals in the basin, rendering them of easy access above the general water level of the country. A few of the lower measures run under the valley of the Toby, and rise on either side, as we approach the anticlinals, to the surface; thereby exposing the whole series of measures from the Old Red Sandstone up. These measures are composed of sandstone rocks, separated by the coal seams and their associated strata of ferruginous and argillaceous shales, fire-clays, iron ores, and limestones.

This great body of land is divided into several parts, locally known as the Rattlesnake, Balltown, Steam Mill, Sandy Lick, Rogers' Run, Thompson's Run, Brandy Camp, Kyler's, Little Toby, and Kersey tracts or lots, and are nearly all connected, as reference to the map will more fully explain.

We commenced our explorations, with several assistants, by opening the various seams of coal and ores on the several tracts, and exposed the same seams in different places. Taking careful levels and measurements of the several tracts containing minerals, we made accurate sections from which the the accompanying general section is made up.

These results were obtained from sixteen different sections, taken in different localities and lots, and as evidence of the general uniformity of the measures, the levels of one section when applied to other locations directed in almost every instance where to find and open the sought-for seam of coal, ore, or limestone.

We had the iron ores between C and D on the section stripped from top to bottom in several places, to be sure of their continuance or persistence. The fossiliferous limestone, containing small bivalve shells, served as a good base line of operations; for the measures higher up in the series, a good line was furnished in the upper limestone. All the seams of coal and ore are very readily opened, as well as the bands of limestone, and I have never explored any country where the minerals are so easily accessible. The minerals contained in these lands consist of cannel and bituminous coals, iron ore in superabundance, two belts of limestone, with several beds of good and valuable fire-clays.

After we had taken several sections with the dip, (which is very gentle in all these measures, being only about 4° to the horizon,) to the N. W., we found the synclinal axis, or bottom of the basin, up Mead's Run, about one and a-half miles from the steam mill on the Toby, and again two and one-fourth miles from Balltown mills, on County Line Run. North of this point, the dip of the strata was uniformly found in the opposite direction, determining with sufficient accuracy for all practical purposes, the point best adapted for advantageous mining and drainage.

## Of the Coal.

We found, in the whole series of the coal-measures on these lands, thirteen seams of coal, with a thickness of over twenty-five feet, five of which are workable at present and two more in the remote future. These five seams embrace about seventeen feet in thickness of workable coal.

The highest seam of coal, marked N on the section, when opened under a good mine roof, as on Limestone Run, and other streams, invariably measured 4 feet 7 inches; though in other localities it was exposed to only 4 feet 2 inches in the outcrop. I have estimated its product, after making ample deduction for mine-waste, pillars, and refuse material left in the mine, to be at least 3,666 tons, to the acre, of good, clean, merchantable coal.

The second workable seam in the series is marked M on the section, and its thickness—3½ feet—is quite uniform. It is of good quality and will produce 3,500 tons per acre of clean coal, besides mine-waste, &c.

The third workable seam of coal is mostly cannel, and is found on trial to be equal to that on Coal River, Virginia, and much more uniform in thickness than that of Kentucky. It consists of 4 inches bituminous coal, and 2 feet 4 to 5 inches of cannel, varying only one inch in a distance of six miles. It is invariably found at the distance marked on the section above the upper limestone, and will work, of good cannel, 2,500 tons per acre, besides the bituminous portion, mine-waste, &c.

For quality of this and other coals, see the analyses, as per enlarged section.

Not quite equal to the Breckenridge, it is still very rich in oleaginous matter, and will produce good illuminating and lubricating oils, and in sufficient quantity to make it very profitable, independent of its superior quality for gas purposes. Besides, it is much nearer the market, and mines much more easily than that of Breckenridge, rendering it on the whole fully as profitable.

Coal K is rather thin to work at present, but of excellent quality.

The fourth workable seam is marked I, and varies from 3 ft. 6 in. to 4 ft. 2 in. in thickness. It is of good quality, and estimated at its minimum thickness, will yield 3,500 tons per acre, of clean, merchantable coal.

Coals H, G, and F, are too thin to work at present.

Coal E is a slaty cannel, rich in oleaginous matter, but will probably not be worked till the larger seam shall have become exhausted.

Coal D is 6 inches thick, and invariably reposes on the great iron ore deposit.

The C vein of coal is the lowest workable seam in the measures. It will work nearly 3½ ft. of clean coal, besides mine-waste, &c. These comprise all the workable seams of coal in the measures, so far as explored. In the space of 100 feet or more, (above Coal N,) as yet undeveloped, other and more valuable seams may exist.

## DETAILED ESTIMATE OF THE QUANTITIES OF COAL ON THE SEVERAL TRACTS.

The Balltown tract contains 7574 acres, including the Mill Lot. On nearly every Warrant, the effects of denudation are apparent, and it became necessary to go over them all, in detail, to arrive at any proper conclusions as to the number of acres underlaid with coal.

| On | | | Acres. | | | | | Tons. |
|---|---|---|---|---|---|---|---|---|
| Warrant 4452 containing 1033½ acres. | N | seam underlies | 368 | works | 3,666 | tons | per acre | 1,349,088 |
| | M | " | 515 | " | 3,500 | " | " | 1,802,500 |
| | L | " | 736 | " | 2,500 | " | " | 1,840,000 |
| | I | " | 825 | " | 3,500 | " | " | 2,887,500 |
| | C | " | 970 | " | 3,000 | " | " | 2,910,000 |
| Warrant 4470 containing 1156 acres. | N | " | 155 | " | 3,666 | " | " | 568,230 |
| | M | " | 346 | " | 3,500 | " | " | 1,211,000 |
| | L | " | 570 | " | 2,500 | " | " | 1,425,000 |
| | I | " | 856 | " | 3,500 | " | " | 2,996,000 |
| | C | " | 1056 | " | 3,000 | " | " | 3,225,000 |
| Warrant 4451 containing 1030 acres. | N | " | 415 | " | 3,666 | " | " | 1,521,390 |
| | M | " | 578 | " | 3,500 | " | " | 2,023,000 |
| | L | " | 850 | " | 2,500 | " | " | 2,125,000 |
| | I | " | 940 | " | 3,500 | " | " | 3,290,000 |
| | C | " | 1030 | " | 3,000 | " | " | 3,090,000 |
| Warrant 4450 containing 1050 acres. | N | " | 190 | " | 3,666 | " | " | 696,540 |
| | M | " | 296 | " | 3,500 | " | " | 1,036,000 |
| | L | " | 436 | " | 2,500 | " | " | 1,090,000 |
| | I | " | 460 | " | 3,500 | " | " | 1,610,000 |
| | C | " | 510 | " | 3,000 | " | " | 1,530,000 |
| Warrant 4453 containing 1050 acres. | I | " | 100 | " | 3,500 | " | " | 350,000 |
| | C | " | 150 | " | 3,000 | " | " | 450,000 |
| Mill Lot, | C | " | 200 | " | 3,000 | " | " | 600,000 |
| | | Making of clean workable coal, . . | | | | | | 39,626,248 |

On Warrants 4469 and 4434 the coal is all lifted out by the anticlinal, and only the two lower seams were exposed on Warrant 4453. A part is cut out by the Walburn, County Line, and Muddy Runs.

The Steam Mill lot contains 4582 acres all underlaid with coal:

| On | | | Acres. | | | | | Tons. |
|---|---|---|---|---|---|---|---|---|
| Warrant 4400 containing 793 acres. | N | seam underlies | 140 | works | 3,666 | tons | per acre | 513,240 |
| | M | “ | 270 | “ | 3,500 | “ | “ | 945,000 |
| | L | “ | 405 | “ | 2,500 | “ | “ | 1,012,500 |
| | I | “ | 656 | “ | 3,500 | “ | “ | 2,296,000 |
| | C | “ | 680 | “ | 3,000 | “ | “ | 2,040,000 |
| Warrant 4342 containing 1010 acres. | N | “ | 177 | “ | 3,666 | “ | “ | 648,882 |
| | M | “ | 415 | “ | 3,500 | “ | “ | 1,452,500 |
| | L | “ | 675 | “ | 2,500 | “ | “ | 1,687,500 |
| | I | “ | 784 | “ | 3,500 | “ | “ | 2,744,000 |
| | C | “ | 1010 | “ | 3,000 | “ | “ | 3,030,000 |
| Warrant 4343 containing 1001 acres. | N | “ | 170 | “ | 3,666 | “ | “ | 623,220 |
| | M | “ | 410 | “ | 3,500 | “ | “ | 1,435,000 |
| | L | “ | 665 | “ | 2,500 | “ | “ | 1,662,500 |
| | I | “ | 775 | “ | 3,500 | “ | “ | 2,712,500 |
| | C | “ | 1001 | “ | 3,000 | “ | “ | 3,003,000 |
| Warrant 4344 containing 995 acres. | N | “ | 168 | “ | 3,666 | “ | “ | 615,888 |
| | M | “ | 405 | “ | 3,500 | “ | “ | 1,417,500 |
| | L | “ | 655 | “ | 2,500 | “ | “ | 1,637,500 |
| | I | “ | 765 | “ | 3,500 | “ | “ | 2,677,500 |
| | C | “ | 920 | “ | 3,000 | “ | “ | 2,760,000 |
| Warrant 4369 containing 783 acres. | N | “ | 138 | “ | 3,666 | “ | “ | 505,908 |
| | M | “ | 360 | “ | 3,500 | “ | “ | 1,260,000 |
| | L | “ | 420 | “ | 2,500 | “ | “ | 1,050,000 |
| | I | “ | 645 | “ | 3,500 | “ | “ | 2,257,500 |
| | C | “ | 675 | “ | 3,000 | “ | “ | 2,025,000 |
| | | Making of workable coal, . . . | | | | | | 42,012,638 |

A portion of the above seams has been cut out by Mead's Run and branches, and by Oyster Run.

The Sandy Lick lot lies between Boone's Mountain on the north, and South Mountain on the south, and embraces 6106 acres. The Sandy Lick and branches empty their waters into the Alleghany River on the west, while the Bennet's Branch of the Sinnemahoning discharges itself into the Susquehanna on the east. At the head of Limestone Run, a spur of Boone's Mountain runs into the coal-measures about one-fourth of a mile, lifting out the coal seams, so that the lower veins underlie only about 5000 acres. The anticlinal axis or Ridge, called Boone's Mountain, separates the coal-measures, at this point, about 2½ miles, forming another coal basin on the south. This tract is covered by seven Warrants, of which 4235 occupies mostly the ridge and has been denuded of coal.

| On | | | Acres. | | | | | Tons. |
|---|---|---|---|---|---|---|---|---|
| Warrant 4226 containing 1022 acres. | M | seam underlies | 80 | works | 3,500 | tons | per acre | 280,000 |
| | L | " | 160 | " | 2,500 | " | " | 400,000 |
| | I | " | 270 | " | 3,500 | " | " | 945,000 |
| | | " | 387 | " | 3,000 | " | " | 1,161,000 |
| Warrant 4234 containing 770 acres. | N | " | 120 | " | 3,666 | " | " | 439,920 |
| | M | " | 310 | " | 3,500 | " | " | 1,085,000 |
| | L | " | 395 | " | 2,500 | " | " | 987,500 |
| | I | " | 480 | " | 3,500 | " | " | 1,680,000 |
| | C | " | 560 | " | 3,000 | " | " | 1,680,000 |
| Warrant 4229 containing 979 acres. | N | " | 722 | " | 3,666 | " | " | 2,646,852 |
| | M | " | 950 | " | 3,500 | " | " | 3,325,000 |
| | L | " | 970 | " | 2,500 | " | " | 2,425,000 |
| | I | " | 979 | " | 3.500 | " | " | 3,426,000 |
| | C | " | 979 | " | 3,000 | " | " | 2,937,000 |
| Warrant 4231 containing 694 acres. | N | " | 675 | " | 3,666 | " | " | 2,474,550 |
| | M | " | 694 | " | 3,500 | " | " | 2,429,000 |
| | L | " | 694 | " | 2,500 | " | " | 1,735,000 |
| | I | " | 694 | " | 3.500 | " | " | 2,429,000 |
| | C | " | 694 | " | 3,000 | " | " | 2,082,000 |
| Warrant 4230 containing 659 acres. | N | " | 659 | " | 3,666 | " | " | 2,415,894 |
| | M | " | 659 | " | 3,500 | " | " | 2,306.500 |
| | L | " | 659 | " | 2,500 | " | " | 1,647,500 |
| | I | " | 659 | " | 3,500 | " | " | 2,306,500 |
| | C | " | 659 | " | 3,000 | " | " | 1,977,000 |
| Warrant 4090 containing 970 acres. | N | " | 520 | " | 3.666 | " | " | 1,906,320 |
| | M | " | 650 | " | 3,500 | " | " | 2,275,000 |
| | L | " | 770 | " | 2,500 | " | " | 1,925,000 |
| | I | " | 840 | " | 3,500 | " | " | 2,940,000 |
| | C | " | 860 | " | 3,000 | " | " | 2,580.000 |
| | | Making of clean workable coal, . . | | | | | | 56,848,036 |

The ROGERS' RUN tract occupies the high table lands between the Little Toby and Brandy Camp Creeks, about two miles above their junction.

It lies 300 feet above the Toby, and contains five workable seams of coal, all of which, together with the ores and limestones were satisfactorily exposed. This tract is covered by

| | Acres. | | Per Acre. | Tons. |
|---|---|---|---|---|
| Warrants 4245 & 4246 containing 1182 acres. | 470 | are underlaid by N seam, working | 3,666 | 1,723,000 |
| | 624 | " M " " | 3,500 | 2,184,000 |
| | 766 | " L " " | 2,500 | 1,915,000 |
| | 905 | " I " " | 3,500 | 3,167,500 |
| | 1050 | " C " " | 3,000 | 3,150,000 |
| | Making of clean workable coal, | | . . | 12,139,500 |

Rogers' Run cuts out 132 acres of the coal on this lot, but the fossiliferous limestone underlies the whole. A little above this lot, on Warrant 4079, on the Kyler Branch of the Little Toby, is another tract of 518 acres, underlaid by the fossiliferous limestone, the iron ores, and two seams of coal: the upper one is the I vein; it underlies 275 acres of this lot, works 3,500 tons per acre, making 962,500 tons. The C vein underlies 350 acres, works 3000 tons per acre, equal to 1,050,000 tons, making in all 2,012,500 tons of clean coal.

On the Little Toby, on Warrants 4079 and 4080, lies another tract of 697 acres, which is underlaid by the lower limestone, iron ores, and the two lowest workable seams of coal. The upper one, the I vein, underlies 425 acres, works 3500 tons per acre, yielding 1,487,500 tons. The C vein underlies 512 acres, works 3000 tons per acre=1,536,000 tons, making of workable coal 3,023,500 tons.

On the head waters of Brandy Camp Creek, is a tract of 1705 acres, covered by Warrants 4371, 4372 and 4249, two of which are underlaid with coal.

| | | | Acres. | | Tons. |
|---|---|---|---|---|---|
| Warrant 4372 containing 1155 acres. | N | seam underlies | 620 | works 3,666 tons per acre | 2,272,920 |
| | M | " | 700 | " 3,500 " " | 2,450,000 |
| | L | " | 725 | " 2,500 " " | 1,937,500 |
| | I | " | 850 | " 3,500 " " | 2,975,000 |
| | C | " | 940 | " 3,000 " " | 2,820,000 |
| Warrant 4249 containing 110 acres. | M | " | 40 | " 3,500 " " | 140,000 |
| | L | " | 65 | " 2,500 " " | 162,000 |
| | I | " | 80 | " 3,500 " " | 280,000 |
| | C | " | 110 | " 3,000 " " | 330,000 |
| | Making of workable coal, | | | . . . | 13,367,920 |

Below this tract, on the Thompson Run Branch of the Brandy Camp, is a small tract containing 368 acres, underlaid by the I and C veins, as follows:

| | | | | |
|---|---|---|---|---|
| The I seam underlies | 150 acres, | works | 3500 tons per acre = | 525,000 tons. |
| " C " | 200 " | " | 3000 " " | 600,000 " |
| Making of workable coal, . . | | | | 1,125,000 " |

The last coal tract of these lands is known as the Rattlesnake Lot. It is covered by five Warrants, and contains 3664 acres. The anticlinal of Boone's Mountain passes through a portion of this tract, and the Rattlesnake Run and branches have cut out the top seams of coal to some extent.

| On | | | Acres. | | | |
|---|---|---|---|---|---|---|
| Warrant 4242 containing 367 acres. | N | seam underlies | 75 | works | 3.666 acres, | Has no mine roof. |
| | M | " | 85 | " | 3,500 | 297,500 tons. |
| | L | " | 100 | " | 2,500 | 250,000 " |
| | I | " | 180 | " | 3.500 | 630,000 " |
| | C | " | 244 | " | 3,000 | 732,000 " |
| Warrant 4241 containing 994 acres. | M | " | 225 | " | 3.500 | 787,500 " |
| | L | " | 310 | " | 2,500 | 775,000 " |
| | I | " | 450 | " | 3,500 | 1,575.000 " |
| | C | " | 665 | " | 3,000 | 1,995,000 " |
| Warrant 4238 containing 1004 acres. | M | " | 225 | " | 3.500 | 787,500 " |
| | L | " | 320 | " | 2,500 | 800.000 " |
| | I | " | 500 | " | 3,500 | 1.750.000 " |
| | C | " | 667 | " | 3,000 | 2,001.000 " |
| Warrant 1534 containing 801 acres. | L | " | 260 | " | 2,500 | 650,000 " |
| | I | " | 375 | " | 3,500 | 1,312.500 " |
| | C | " | 538 | " | 3,000 | 1,614,000 " |
| Warrant 1535 containing 498 acres. | L | " | 150 | " | 2.500 | 375,000 " |
| | I | " | 230 | " | 3,500 | 805,000 " |
| | C | " | 328 | " | 3,000 | 984,000 " |
| Making of workable coal, . . | | | | | | 18,121,000 " |

The Kersey Tract lies along the foot of Boone's Mountain, and on the northern side, mostly in the valley of the Toby Creek. The axis forming Boone's Mountain has lifted the coal-measures all out so that it contains no coal.

## Of the Timber.

Except some 600 acres on Boone's Mountain, and at Balltown where 100 acres are cleared, all these lands are covered by a heavy growth of timber, consisting of a superior quality of White Pine of the soft kind, Hemlock, Red Beech, Birch, Maple, White and Black Oak, and Chestnut.

I made a very careful examination of the timber on these lands, with a view to determine, as nearly as possible, the quantity and economic value, and was materially aided in my estimates by Mr. Little, a gentleman quite familiar with these lands, and well versed in lumbering. Several days' examination has led to the following results, on which I think you may with confidence rely:

The Kersy tract, above mentioned, covered by parts of Warrants 4093, 4094, 4095, and 4096, will yield 11,330,000 feet of lumber.

The Balltown tract will yield of White Pine (the only timber estimated) 67,036,000 feet, board measure.

| | | | | | |
|---|---|---|---|---|---|
| The Brandy Camp | tract | will | yield | 9,164,000 | feet. |
| The Rogers' Run | " | " | " | 9,400,000 | " |
| The Kyler | " | " | " | 1,720,000 | " |
| Thompson Run | " | " | " | 3,075,000 | " |
| The Little Toby | " | " | " | 2,100,000 | " |

The lumber from the above tracts can be floated or rafted down the Little Toby, or Brandy Camp Creek, both of which streams are navigable for rafts through these tracts, and furnish excellent mill seats.

Sandy Lick tract will furnish 135,000,000 of feet, board measure. This tract is admirably situated for lumbering, having a very even surface on either side of Sandy Lick; the stream is large enough for mills, and has fine mill-seats. Four miles below, the stream is large enough for rafting to the

Alleghany, down which is the most extensive market on the continent, reaching all the way to New Orleans. On the other or eastern side of this tract, Bennet's Branch of the Sinnemahoning furnishes fine water-power. Four miles below, on this side, they make up their large rafts for the Susquehanna, which also furnishes an outlet to an extensive market for lumber.

Of the hemlock and hard woods on these lands, I think the most profitable use to which they could be applied would be the manufacture of cold-blast charcoal iron. There are about 28,000 acres covered with a heavy growth of hemlock and hardwoods, which would average, at least, 40 cords of wood per acre. Eighty bushels of charcoal per cord is a fair average yield, when attention is given to burning, but 75 bushels per cord gives 3000 bushels per acre. Now, as it requires 300 bushels of charcoal to make a ton of pig metal, from average ores, it follows that each acre has enough fuel to produce 10 tons of iron, making 280,000 tons of iron that may be manufactured from the wood on these lands.

Cold-blast charcoal iron would be most profitable, as it could be sold to government at high prices, there being comparatively little made, and no other kind used in the ordnance department.

Owing to the great and increasing demand for white pine lumber, and the rapidity with which the country is being denuded of it, as well as the limited area now covered by it in the United States, the time has already come which adds value to lands growing it. It is now considered, any where along the Alleghany River, worth three dollars per thousand feet, board measure, standing—commonly called "stumpage." In many parts of eastern Pennsylvania, white pine is worth six dollars stumpage, and, I think, three dollars for your timber would be full low enough for the present time. As regards the estimate of quantity, I think it is not overrated, as, among many cases, I know of no one where the production of the saw was not more than originally calculated.

# Of the Iron Ores.

Of the quantity and general good quality of the iron ores on these lands, no doubt exists. The several bands are noted in their proper places on the accompanying section. The first iron ore (a dark-grey carbonate,) is found in flattened nodules over coal N, imbedded in 8 feet of ferruginous sandy shales, and is equal in quantity to a continuous band of 12 to 14 inches in thickness. Below the fire-clay, associated with coal I, occurs a band of grey, siliceous carbonate, 6 inches thick, which could be obtained very easily in connection with the indurated fire-clay. Coal K has also a ferruginous shale rich in iron, overlying it.

From coal D down to the lower *slab ore*, (a local name for flattened nodules,) occur several bands of ore, as shown in the enlarged section. The band of fine, argillaceous ore, marked No. 3, is easily worked. Then comes a fossiliferous, black-band ore, containing many fossil shells, (the crinita and producta,) with a large portion of carbon. This is an argillaceous ore, and with the carbon which it contains, must work easily, requiring little flux or fuel. It reposes on from 2 to 3 inches of very fine-grained carbonate of iron, in nearly continuous bands. All these ores under coal D can be advantageously wrought together.

Nos. 5 and 4 are an intermixture of ores and shales, 6½ feet in thickness, and contain large quantities of continuous and separated bands of superior carbonate, with rich flattened nodules weighing from 10 to 100 lbs., the whole making (from C to D) 36 inches of solid carbonate, and 24 inches of black-band ores.

This makes of itself five feet of good ores, besides Nos. 1, 2, 6 and 7. Nos. 6 and 7 are quite extensively worked at the furnaces on the Clarion and Alleghany rivers.

For qualities of ores, see analysis.

In estimating the quantity of ores, it is usual to allow 9 cubic feet for a ton of ore. This makes allowance for waste of mine in pillars, &c. Also, to allow 3 tons of ore for a ton of pig metal. This is a liberal allowance for waste, roasting, &c. Nos. 3, 4 and 5 will furnish 5 feet of ore equal to 24,200 tons per acre, or 8,000 tons of pig metal.

As most of the ores cover more ground than the coal seam I, to make allowance for all contingencies, I have estimated only the number of acres underlaid by that vein, viz., on

| | | | | | |
|---|---|---|---|---|---|
| Rattlesnake, | 1735 | acres | yielding 8000 tons | per acre, | 13,880,000 |
| Balltown, | 3181 | " | " | " | 25,440,000 |
| Steam Mill, | 3625 | " | " | " | 29,000,000 |
| Sandy Lick, | 3922 | " | " | " | 31,376,000 |
| Roger's Run, | 905 | " | " | " | 7,240,000 |
| Thompson Run | 150 | " | " | " | 1,200,000 |
| Brandy Camp, | 930 | " | " | " | 7,640,000 |
| Kyler's Branch | 275 | " | " | " | 2,200,000 |
| Little Toby, | 425 | " | " | " | 3,400,000 |
| | | Making of tons of pig metal, | | . . | 121,376,000 |

Without estimating any of the slab ores, or the 5 feet band lying below the conglomerate, Nos. 3, 4 and 5 will furnish more ore than will be wanted, and work easier and cheaper than any of the gray, siliceous carbonates, *which more than equal the above in quantity.* In making cold-blast, charcoal cannon-iron for government, which requires a particular kind of grain or texture, it may become necessary to mix some of the gray carbonates to obtain it, otherwise the mixture of Nos. 3, 4 and 5 will be sufficient to work easily and produce excellent iron.

Ample supplies of fire-clay exist, for either fire-brick or furnaces. A good belt overlies the great ore-bank under coal D, and another is found under seam I. The manufacture of fire and furnace-brick is, in many sections, a large and remunerative branch of business, and could be profitably carried on in the Toby valley.

A great superabundance of limestone exists in these lands, for making iron, and for agricultural and other purposes. Both beds are persistent all over the country. The upper or non-fossiliferous is invariably above water level; the lower bed is in many places above water level, in others below it. The upper one can supply enough for all purposes of manufacturing iron. These lands lie in the middle of the great basin extending from Potter to Greene counties, embracing the large coal and iron region of Pennsylvania west of the Alleghanies, and destined soon to become the great central, iron manufacturing district of the State. Here all the materials exist in abundance on the ground, to produce iron of the best quality, which can be made at so low a price as to place competition out of the question, from any other quarter where like facilities do not exist — that is to say, where either the coal, ore, or limestone has to be transported to the furnaces from other places.

The Sunbury and Erie, Alleghany Valley, and Buffalo and Bradford Railroads, now in process of construction, and others projected through and near this property, will soon afford facilities for the transportation of the mineral products of this region to the great manufacturing cities of this and adjoining States, the Lakes and Canadas.

## Of the Soil.

Almost the entire tract is susceptible of easy and successful culture.

Mostly occupying the high table lands or plateaus, the surface is smooth and regular, and the property on which I am reporting would all make good farms, except where the streams have formed ravines, the sides of which are too steep for tillage.

The soil is generally good, producing large crops of the cereals and other grains; well adapted to grazing, and would not require fertilizing manures for some years. But the great abundance of limestone affords ready means for improving the soil at any time, and to any desired extent, affording increased resources for developing and working the estate.

Mining and manufacturing operations require a large population, consuming vast quantities of agricultural products, and those who undertake such operations should carefully foster agriculture, in order to obtain a home supply of a portion of their necessities.

## Of Salt.

I regard the prospects for obtaining salt water, favorably. The synclinal axis crosses County Line Run about 2¼ miles from Balltown mills, and the bottom of the basin is the only eligible place for boring with a prospect of obtaining saline deposits. Here the porous Old Red Sandstone, which contains them, lies at some depth below the coal-measures, and does not rise to the surface till it passess the anticlinal axis near the Clarion River at Ridgeway, on the north, and Boone's or Elk Mountain on the south. Neither is the sandstone cut longitudinally by the Little Toby or Clarion River, to afford any drainage of the salines. Here, then, at the point designated, exist all the conditions requisite to the existence of an unlimited supply of brine, which, if obtained, would be attended with profitable and incalculable advantage.

At the northern terminus of this basin, in Potter county, the coal-measures are all lifted out—the Old Red Sandstone is exposed, and the saline springs which rise from it have become feeble, and will not pay for working.

On County Line Run, all these outlets or drains have remained closed, the saline waters have been retained, and I think the probabilities of success will fully warrant the expense of the boring rod.

## RECAPITULATION.

| Names of Tracts. | Ore for Tons of Pig Metal. | Tons of Cannel Coal. | Tons of Bitumin's Coal. | Ft. of Timber in board measure. |
|---|---|---|---|---|
| Rattlesnake contains, | 13 880,000 | 2,850,000 | 15,271,000 | Pine sold. |
| Balltown “ | 25,440,000 | 6,480,000 | 33,146,638 | 67,036,000 |
| Steam Mill “ | 29,000,000 | 7,050,000 | 34,962,638 | Pine sold |
| Sandy Lick “ | 31,376,000 | 9,120,000 | 47,728,036 | 135,000,000 |
| Rogers' Run “ | 7,240,000 | 1,915,000 | 10,224,520 | 9,440,000 |
| Brandy Camp “ | 7,640,000 | 2,100,000 | 11,267,920 | 9,164,000 |
| Thompson's Run “ | 1,200,000 | | 1,125,000 | 3,075,000 |
| Kyler's Branch “ | 2,200,000 | | 2,012,500 | 1,720,000 |
| Little Toby “ | 3,400,000 | | 3,023,500 | 2,100,000 |
| Kersey “ | | | | 11,330,000 |
| | 121,376,000 | 29,515,000 | 158,761,752 | 238,865,000 |

## SUMMARY OF RESOURCES.

| | |
|---|---|
| Bituminous coal, | 158,761,752 tons. |
| Cannel coal, | 29,515,000 “ |
| Ore for the manufacture of metal, | 121,376,000 “ |
| Wood for charcoal to make tons of pig metal, | 280,000 “ |

Timber for the manufacture of 238,865,000 feet of lumber.

Say, 30,000 acres good farming land,

And a fair prospect of obtaining, with comparative ease, an abundant supply of saline water for the manufacture of salt.

In reviewing the productive capacity of these lands, one must be convinced of its magnitude and importance. The principal articles of manufacture would be lumber, coal-oil, iron and salt.

The average cost of manufacturing lumber in the vicinity of these lands, and delivering at the Cincinnati or Louisville market, for the last few years, has been from 7 to 8 dollars per thousand, and prices have ranged from 14 to 18 dollars per thousand. You will readily perceive that an immense profit can be realized from the 238,000,000 feet of pine with which this tract is covered.

Another unquestionable source of profit is the manufacture of coal-oal. Whether it will be found most advantageous to refine it at the mines, remains to be determined. The cannel coals of this region are well calculated for its production, and will yield 50 gallons crude oil per ton.

The expense of mining, distillation, freight, cooperage, and incidental expenses, do not exceed 15 cents per gallon, and if the price is reduced to 30 cents per gallon, for the crude oil, to meet the competition which we may reasonably expect, leaving a profit of 15 cents per gallon, or $7.50 per ton, you will readily perceive what a source of profit may be derived from the thirty millions tons of this kind of coal, which your property in the Toby Valley contains.

As regards the manufacture of iron, I know of no place where it can be produced so cheaply on the Atlantic slope of the Alleghanies. At this place, we bring our ores and limestone 70 miles by railroad, and our coal costs 65 cents per ton at the mines near by—say 70 cents at the trundle head of the furnace, and the net cost is $16.17 per ton.

I think it could be made on this property, where all the material is on the ground, at a cost not exceeding $11.50 per ton, viz: The coal can be delivered at head of the furnace for 70 cents, iron ore for 90 cents, and limestone at 75 cents per ton. Two tons of raw coal are now used in England for making a ton of metal, and are equal to 2¼ tons, coked; but calling it

| | |
|---|---|
| 2¼ tons of coal @ 70 cents, gives . . . . . | $1.57½ |
| 3 " ore (an ample supply,) @ 90 cents, gives . | 2.70 |
| Labor at furnaces, per ton, . . . . . . | *5.00 |
| ½ to ¾ ton limestone, say . . . . . . . | .50 |
| Contingencies, say 15 per cent,. . . . . | 1.61 |
| And you have for the production per ton, . | $11.38½ |

This would give a profit of at least eight dollars per ton, with or without a tariff.

These lands contain fuel enough for the production of eighty million tons of pig metal, and to work that amount up, say in one hundred years, would require 80 blast furnaces with 18 feet boshes, producing 200 tons each per week, for all that time.

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* Five dollars cover all expenses here for manufacturing into pigs.—B. N.

To work these lands commensurate with the increasing demand for iron, the use of which is now being doubled about every ten years, 10 large furnaces with 18 feet boshes, (as that diameter has on experiment proved to be about the true medium, and most economical,) averaging 1000 tons per annum, with two rolling mills attached, would become necessary.

I have included the manufacture of salt on these lands in reviewing their capabilities of production. The existence of abundant material for this branch of business is not problematical, though unlike the timber, coal, or iron, it does not stand out so prominently to view. Yet when the attention of scientific and practical business men is once directed to such certain evidences of its location, means will be used to develope it, and a new branch of business spring up in Northern Pennsylvania, not less called for nor remunerative than those previously mentioned.

From the foregoing review you can form an appreciable estimate of the profits which the vast resources of these lands could furnish.

To go into extensive details on this subject would carry me beyond the limits of a mere practical report. Suffice it to say, that the practical development of these lands will fully substantiate all I have said of them, and as fully justify the attention of large capitalists.

Trusting the above views which I have taken of your property may prove satisfactory,

I remain, Sir,

Very respectfully yours, &c.,

B. NEEDHAM,

Mining Engineer and Geologist.

SCRANTON, Jan. 20th, 1857.

# Coal Oils.

EXTRACT FROM MINERS JOURNAL.

"The marvelous qualities of cannel coal for the production of oils, naptha and candle wax or paraffine, are truly astonishing, and would scarcely be credited, were they not fully substantiated by actual experience in Scotland and England, placing the matter beyond dispute. The oil is extracted by a process very similar to that of making gas at our gas establishments, though at a much lower temperature, and the volatile matter leaves the retort as a liquid instead of gas, as in the case where a great degree of heat is used.

"By a process of making, one ton of cannel coal produces about 140 gallons of *crude* oil, which, when distilled, will produce more than forty gallons of *pure* oil, equal to the best sperm oil for burning, lubricating, &c., twenty-five gallons of naptha and fifteen to twenty pounds of candle wax, more beautiful than and far superior to sperm; making the product of a ton of this coal worth from 75 to 100 dollars.

"This oil is equal to the best sperm for lubricating and burning, and it has also been successfully used in painting; and when it is mentioned that for lubricating purposes alone the expenditure for oil by the railway companies of the United States and Canada, amounts to over a million of dollars per annum, and that this item is increasing at an enormous rate by railway extensions, besides the immense and growing consumption for all kinds of machinery, it will be readily seen that our estimate of the money value of this extraordinary discovery is by no means overrated.

"The burning oil is very limpid; it resists cold better than the purest sperm, does not gum the wick, and gives a clear and brilliant light.

"The lubricating qualities of coal oil are quite unrivaled so much so, that in the manufacturing districts of England the use of sperm oil as a lubricator for machinery, has been discontinued, and kerosene or mineral oil is substituted, as being far superior and much cheaper. Mineral oil from the Scotch Boghead Coal or Torbane, was first introduced into the English manufacturing districts in 1852, and was then viewed with suspicion, as being one of a thousand and one impracticable attempts to manufacture a cheap lubricating machinery oil. It was offered at five shillings sterling per gallon."

Dr. Kent, of New York, illustrates the comparative value of light from coal and bituminous shales as follows:

| MATERIAL. | Quantity of light from equal measures. | Cost of equal amounts of light. | Retail price per gallon. | Intensity of light. |
|---|---|---|---|---|
| Kerosene or Oil of Coal, . | 2.435 | $ 4.10 | $1.00 | 13.689 |
| Camphene, . . . | 1.293 | 4.85 | .63 | 5.625 |
| Sylvic Oil, . . . . | .826 | 6.05 | .50 | 1.190 |
| Rapeseed Oil, . . | 1.660 | 9.00 | 1.50 | 5.929 |
| Whale Oil, . . . . | .833 | 12.00 | 1.00 | 1.892 |
| Lard Oil, . . . . | .706 | 17.70 | 1.25 | 1.640 |
| Sperm Oil, . . . . | .850 | 26.47 | 2.25 | 2.025 |
| Burning Fluid, . . | .390 | 29.00 | .87 | .553 |

# EXTRACT

FROM

# Dr. D. D. Owens' Geological Report

## ON THE STATE OF KENTUCKY.

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Between thirty and forty years ago, when the iron trade in Scotland received a fresh impetus by the introduction into the business of various improvements, and a new raw material, hitherto overlooked or considered impracticable, a family of the name of Baird owned a small farm of some thirty or forty acres between seven or eight miles from Glasgow.

This property was underlaid by a bed of coal—the Monkland coal seam—which was worked to a very limited extent by the proprietors, and hauled by *single cartloads* to the Glasgow market.

Partly from this small coal business, and partly from the products of the farm, the family barely made a living; finding it often difficult to make the two ends meet. So limited, indeed, was their means, that the father considered the business inadequate to the support of the family, so that as the two eldest sons grew to manhood, he urged upon them the necessity of seeking a livelihood elsewhere, in some other business.

During the excavations for the coal on the farm, a kind of ironstone had been encountered, and considerable quantities taken out, which lay scattered in piles at the mouth of the pit, as worthless rubbish, encumbering the ground.

At one of these family meetings, while counciling in regard to future prospects, it was suggested by the eldest son that perhaps they might be able to make iron profitably from some of these waste ironstones. The father, supposing the amount of capital required to commence such a business entirely beyond their limited means, thought, at first, such an enterprise out of the question. Finally, however, by uniting the whole savings of the family, and effecting certain small loans, the father and sons managed to erect, with the sum of £1200, an iron furnace for the production of pig iron from their black-band ironstone and coal.

The business succeeded beyond their expectations; in a few years they were not only able to pay off the borrowed capital, but had laid up a surplus sufficient to erect another furnace. Soon they were able to purchase adjoining coal and iron property, and lease the mining right for black-band ore on other estates. This being about the time of the first successful introduction of that species of ore for making iron, its real intrinsic value was, as yet, but little known, so that they were enabled to obtain mining rights for this ore at a shilling a ton, while some of their neighbors in the same business, starting later in this branch of the trade, paid 15, 16, and even as high, in some instances, as 18 shillings per ton for their mining right or lordship.

Progressing in the business under such favorable auspices, wealth flowed in fast, and they were enabled to extend their business rapidly, and put into operation furnace after furnace, in rapid succession, and add, from time to time, considerably to their mineral lands. Ultimately, on their well known estate of Gartsherry, celebrated throughout Scotland, there were sixteen furnaces in blast, besides three or four more in Ayrshire.

That Baird family are now in the annual receipt, from their coal and iron works, of a clear profit of half a million of pounds sterling, or two and a half million of dollars; wielding a monied influence beyond even the princes of the land.

Let it be forcibly impressed on the minds of my readers that this immense wealth was not amassed by speculation, but by legitimate earnings from a business producing an article of the greatest intrinsic value—a metal to which Great Britain owes, perhaps, more than to any of her other numerous manufactured products, her national greatness—and giving at the same time, constant employment to whole towns of industrious inhabitants; the material from which all this wealth was extracted, a mineral taken from the bowels of the earth, regarded for centuries as worthless.

Thus it is that Great Britain has risen to the apex of commercial prosperity; thus it is that the United States, at this very moment, is paying her "a golden tribute" of $30,000,000 annually for imported iron alone; thus it is that her iron manufacturers can raise their millions with as much ease as we our thousands.